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Placer-gold Deposits Wheaton (Boulder) Creek Cassiar District Northern British Columbia

by

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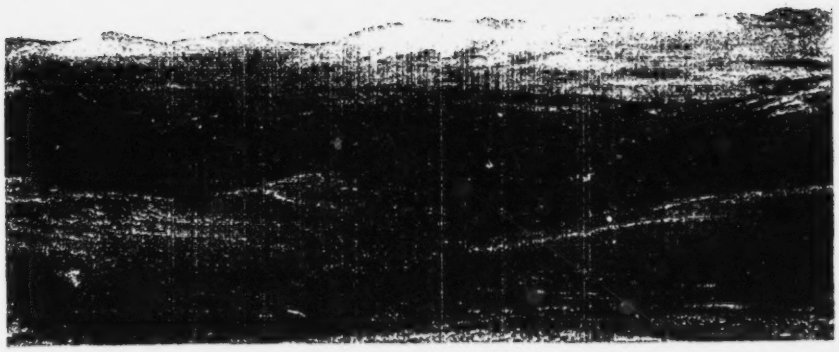
Wheaton Creek in rock canyon on the Amanda lease and flanked by high gravel benches.

Wheaton Creek meandering in flat-bottomed rock canyon at the south end of the Philippon lease. Rock bench remnant in the background.



View northward across Alice Shea and Wheaton Creeks towards the Turnagain Valley.

King Mountain at the head of the West Fork of Ferry Creek.

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PLACER-GOLD DEPOSITS

WHEATON (BOULDER)* CREEK, CASSIAR DISTRICT

The Cassiar district has long been known for its placer and lode-gold possibilities. The discovery in 1873 of rich gold-bearing gravel on Thibert Creek led to the finding of placer-gold on Dease Creek in the same year, and on McDame Creek in 1874. After a long period of inactivity and small gold production, placer-gold was found on Goldpan Creek in 1924. Later, in 1934, gold-bearing quartz veins were found on Quartz Creek at the head of McDame Creek. Interest in the district was again renewed by the discovery in 1937 of a 52-ounce 15 dwt. gold nugget on Alice Shea Creek, a tributary of Wheaton Creek, and the discovery in 1938 of rich, shallow pay-gravel on the Peacock lease (No. 345), on lower Wheaton Creek.

SUMMARY

1. Wheaton (Boulder) Creek is a tributary of Turnagain River. By trail it is roughly 45 miles east of the south end of Dease Lake.

2. The creek lies within the Cassiar Mountains. The maximum relief, about 4500 feet, is between King Mountain (7890 feet) and Turnagain River at the mouth of Wheaton Creek (3414 feet).

3. Turnagain River meanders on a low grade amongst innumerable kettle-hole lakes in the flat bottom of a wide trench-like valley with prominent benches along its sides.

4. Wheaton Creek, like many of the other tributaries, drops over falls into the valley of the Turnagain. It flows in a hanging valley whose gentle grade in the upper stretches becomes progressively steeper towards the creek mouth. Northward from Alice Shea Creek, Wheaton flows in a rock canyon which deepens to the north.

5. A correlation of rock bench remnants along Wheaton Creek indicates that the bottom of the pre-glacial valley had a gentle grade. Three other levels represent progressive

*The Geographic Board of Canada has approved the change from the local name Boulder Creek to Wheaton Creek--the latter usage will be followed throughout this report.

stages in the pre-glacial downcutting of the creek.

6. The country was glaciated in two periods, separated by an interglacial stage. Glaciation in neither was sufficiently destructive to disperse the placer-gold accumulations.

7. On Wheaton Creek a belt of serpentine 3 miles wide is flanked by slate, argillite, limestone and andesitic volcanics. The serpentine includes remnants of the sedimentary cover and is intruded by diorite and quartz-diorite.

8. There are many quartz stringers and veins in the slate and schist. Some are mineralized with pyrite, but none are known to be gold-bearing.

9. From 1935 to 1939, the total production of crude gold has been 4852 ounces, valued at $140,708.00. This came mainly from two leases on Wheaton Creek and one on Alice Shea Creek.

10. The placer-gold being mined on the Peacock lease lies below creek-level on flat-lying bedded clay which rests on the bed-rock of an interglacial channel. On Alice Shea Creek the gold is on bed-rock beneath a few feet of gravel in the bottom of the creek. On the Elvira lease (No. 402) the gold is a recent concentration on bed-rock below creek-level in the lower canyon of Wheaton Creek.

11. The placer-gold on the Peacock lease did not migrate downstream from a source on Alice Shea Creek. The difference in fineness of the gold strongly suggests that the placer concentrations came from different sources.

12. Most of the placer-gold is believed to have come from the erosion of auriferous quartz veins in the slate and schist. Some on Alice Shea Creek appears to have come from an auriferous pegmatite or feldspathic quartz vein. Some may have come from mineralization in serpentine, though no veins in serpentine have been seen.

13. On Wheaton Creek, where creek-grade and depth of gravel are favourable, the auriferous gravel is worked by booming or ground-sluicing. On the Peacock lease the gravel below creek-level is excavated by a 7/8-yard drag-line shovel, and is washed in a moveable sluice-box. Any tailings that accumulate and block the sluice-box are stacked by a bull-dozer. On Alice Shea Creek the shallow gravel is shovelled by hand into a string of 12-inch sluice-boxes and the bed-rock carefully cleaned.

14. The hypothesis of the physiographic history, as developed from the detail on Wheaton Creek, should be useful in directing further prospecting on Wheaton and on other creeks tributary to the head of the Turnagain River.

INTRODUCTION

This report is based on two months' field work spent on Wheaton Creek during the summer of 1939. In the course of work a plane-table and stadia traverse was run to the upper end of the placer leases on Wheaton Creek and on its tributaries, Philippon and Alice Shea Creeks. The topography and geology of Map 381 A of the Department of Mines and Resources, Ottawa, was extended eastward to include Wheaton Creek and the adjoining country.

Location and Access: Wheaton Creek lies in the Arctic drainage area. It is a tributary of Turnagain River, a branch of the Liard. The creek joins the Turnagain close to its head, within 16 miles of a very low divide between a branch of the Turnagain and the McBride River. The latter eventually reaches the Pacific Ocean by way of the Stikine. The creek is roughly 40 miles in a straight line due east of the south end of Dease Lake.

North-bound boats of the Canadian Pacific Railways' coastwise service make weekly calls at Wrangell, Alaska. At Wrangell, river boats of the Barrington Transportation Company connect with the north-bound coastwise steamers. The trip from Wrangell, Alaska, up the Stikine River to Telegraph Creek, B. C., about 150 miles, is generally made in two or three days, though exceedingly high or low water on the river may prolong it. The first boat up the Stikine usually leaves Wrangell between May 15 and June 1, and the last boat down-stream leaves Telegraph Creek sometime between the 7th and 15th of October.

Between Telegraph Creek and Lake House on Dease Lake there is a road on which several trucks operate during the freighting season. Prior to the summer of 1939, most of the freight going from Lake House to Wheaton Creek went by pack-horse over a poor trail. In 1939, fourteen miles of summer tractor-road was built and in winter, tractors can be used all the way to Wheaton Creek. It is possible to arrange airplane transportation for freight or passengers between Dease Lake and Wheaton Creek.

In the summer of 1939 the following rates were effective: freight between Wrangell, Alaska, and Telegraph Creek, B. C., $50.00 per ton; passengers, $30.00 one-way, $45.00 return; freight between Telegraph Creek and Lake House $70.00 per ton; freight between Lake House and Wheaton Creek, by pack-horse, $140.00 per ton; freight between Lake House and Wheaton Creek, by airplane, $100.00 per ton. Food and general supplies may

be obtained at outfitting posts at Telegraph Creek or Lake House. Arrangements for hiring pack-horses can be made at Telegraph Creek.

Climate. Wheaton Creek is in the Cassiar Mountains and consequently has more rain than the "dry belt" around Telegraph Creek. The precipitation probably averages about 30 inches a year. Conditions from year to year range between wide limits and the summer of 1939 was unusually wet. Though the total precipitation was not great, on Wheaton Creek during the last two weeks of June there were twelve days with light showers or rain, in July twenty-two days and in August eleven showery days in the first eighteen. Winter snowfall is about 3 feet, but by July most of the snow has gone from the summits. The only glaciers nearby are on the north side of King Mountain.

In the spring, the rapid melting of the snow and the quick run-off, raise the creek by early June. The maximum flow is short and by August the creek is low. The measured flow of Wheaton Creek on July 18 was 33 second-feet, and on August 16, after a week of fairly heavy rain, it was 31 second-feet. In June, however, the flow was several times as much. The estimated flow of Alice Shea Creek during July and August was between 3 and 4 second-feet.

Inasmuch as the operations on Wheaton Creek are not entirely dependent on water supply, it is possible to work from about the middle of May until late in October. Their operating season is longer than that of a corresponding hydraulic.

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TOPOGRAPHY

Relief. Wheaton (Boulder) Creek lies within the Cassiar Mountains. These mountains lie to the north and east of Dease Lake in a belt that is 50 miles wide or more. They are believed to extend as far to the north-west as Teslin Lake in the Yukon. The same belt runs south-eastward to the headwaters of the Firlay River. In general, the mountains are moderately rugged and deeply dissected by valleys.

To the east and west of Wheaton Creek the valley-sides gradually rise to long, almost flat-topped ridges at about 5,500 feet elevation. Mountain peaks rise above this intermediate level and most of them are between 6,000 and 6,500 feet elevation. One peak, however, King Mountain, elevation 7,890 feet, is the highest point in the Turnagain section of the Cassiar and towers far above any others in its neighbourhood. The maximum relief, about 4,500 feet, is therefore between King Mountain and Turnagain River at the mouth of Wheaton Creek.

Drainage. The Cassiar Mountains around Wheaton Creek are drained by Turnagain River and its tributaries. The mapped area lies close to the divide between the headwaters of the Turnagain and McBride River which, together with its tributaries, eventually drains to the Pacific by way of the Stikine River. Wheaton Creek has evidently been close to the Arctic-Pacific divide for a considerable time. As a consequence, wide, flat or gently-sloping upland areas were never formed to the same extent as they were to the west, or in the Interior Plateaux country to the south.

Turnagain River from its divide with the McBride, at latitude 58 degrees 15 minutes north, flows north for about 8 miles. It then makes almost a right-angled turn to flow slightly north of east for 12 miles, at which point it is beyond the eastern limit of the mapped area. The valley-bottom is flat and about a mile wide. The valley-sides rise moderately to peaks which lie close to 6,500 feet elevation. Prominent benches lying 150 to 400 feet above the valley-floor are an outstanding feature of the valley. One of these, about 250 feet above the river, extends for many miles to the east.

The river flows on a very low grade and meanders between innumerable lakes in the valley-bottom. These lakes are particularly noticeable; some are isolated and separated by drift ridges 25 to 100 feet high; others are connected by the Turnagain River. The lakes, as much as a mile or more in length, are evidently water-filled kettle-holes which were formed by

the melting of stationary blocks of glacial ice. The greatest measured depth in the lake immediately up-stream from the mouth of Wheaton Creek was a sounding of 65 feet below river-level. Numerous tributary creeks join the eastward-flowing stretch of Turnagain River. These from west to east are: Tumble (Falls), Ball, Little Greenrock, Greenrock, Two-Mile, Wheaton (Boulder), Bobner, Ferry, Flat and Hard Creeks. A significant thing about them all is that they enter the Turnagain over falls. The drop of Wheaton Creek is 60 feet: the others are comparable. In general, the streams in the upper ends of the tributary valleys flow on a gentle grade. They steepen down-stream, then fall into the main valley. Their valleys are hanging in relation to that of the Turnagain.

Wheaton Creek joins the Turnagain about 7 miles east of the right-angle bend, just at the 129th meridian. The head of the creek is 4 miles west of King Mountain. Although the creek is not perfectly straight its general course is almost due north to the Turnagain. Two small unnamed tributaries enter it from the east near its head and farther down-stream it is joined, again from the east, by Alice Shea and Philippon Creeks (see Fig. 1). From its head Wheaton Creek flows 5 miles slightly east of north, then gradually bends and flows for 4 miles slightly west of north to its junction with the Turnagain.

In the 4-mile stretch below Alice Shea Creek, Wheaton flows in a canyon which in places is 100 feet deep. Above the steep canyon-sides the upper valley-walls are flaring and rise gradually to more or less flat-topped ridges and higher peaks on each side. Up-stream from the canyon-section, the valley is wide and open with gently rising sides. This valley, in the lower course of the creek, is incised to form the canyon-section.

Although the creek flows in the bottom of a steep-sided rocky canyon, its actual course in sections is slightly meandering. In such sections there are narrow gravel benches or alluvial flats from 50 to 200 feet wide and only a few feet above creek-level.

In general, the longitudinal profile of Wheaton Creek (see Fig. 2) has a very low grade in the upper part of the stream. The grade becomes increasingly steeper towards the mouth until finally the creek drops over a 60-foot fall into the Turnagain River flat.

In particular, (see Figs. 1 and 2) Wheaton Creek, up-stream from a point about 4,500 feet above the mouth of Alice

Fig. 1. Detail map of Wheaton, Philippon, and Alice Shea Creeks.

Shea Creek, meanders on a 0.7 per cent. grade in the bottom of a more or less flat-bottomed, widely-flaring valley. Downstream to a point 1,200 feet above Alice Shea Creek, Wheaton Creek meanders on a low grade, 0.3 per cent. in one stretch, over a flat alluvial bottom about 200 feet wide. On either side of the valley-bottom, low rock bench remnants progressively rise down-stream to a height of 30 feet above creek-level. From the point 1,200 feet south of Alice Shea Creek to a point midway on the Roosevelt lease (No. 336), the average grade of the creek is 2.5 per cent. In this stretch, although the general course of the creek is straight, there are occasional small meanders. The meandering is confined by steep rocky canyon-sides to an alluvial flat which ranges from about 50 feet wide at the lower end to about 200 feet wide at the upper. The canyon-walls in this section increase down-stream to a height of 100 feet above the creek. Nowhere does bed-rock outcrop in the creek-bottom. A shaft and drill-hole at the northern end of the Caribou lease (No. 360) indicate that the creek at that point flows over at least 31 feet of valley-fill.

For a short stretch on the Roosevelt lease (No. 336) the creek runs on a 7.6 per cent. grade in a narrow canyon.

From 1,000 feet south of the No. 1 post of the Roosevelt lease (No. 336) to 200 feet south of the No. 1 post of the Peacock lease (No. 345), the creek flows on a 1.9 per cent. grade. The creek no longer is confined in a canyon and the valley has widened. Though there are rock bench remnants on either side, the flat reaches a maximum width of about 250 feet. No bed-rock is exposed in the creek-bottom and a shaft on lease No. 336 and the drag-line cut on lease No. 345 indicate that the creek flows over at least 26 feet of unconsolidated material lying above bed-rock.

The creek enters a narrow steep-walled rock canyon just north of the No. 1 post of the Peacock lease (No. 345), and drops on an average grade of 4.9 per cent. to the Wheaton Creek Falls, which is 60 feet high. In this section, the creek flows on bed-rock or over as much as 10 feet of gravel between canyon-walls which are from 50 to 100 feet above creek-level. Rock bench remnants about 30 feet high line the creek on each side.

From the foot of the falls, Wheaton Creek flows on a 1.4 per cent. grade across the alluvial valley-flat of Turnagain River. The elevation of Turnagain River at its confluence with Wheaton Creek is 3,414 feet.

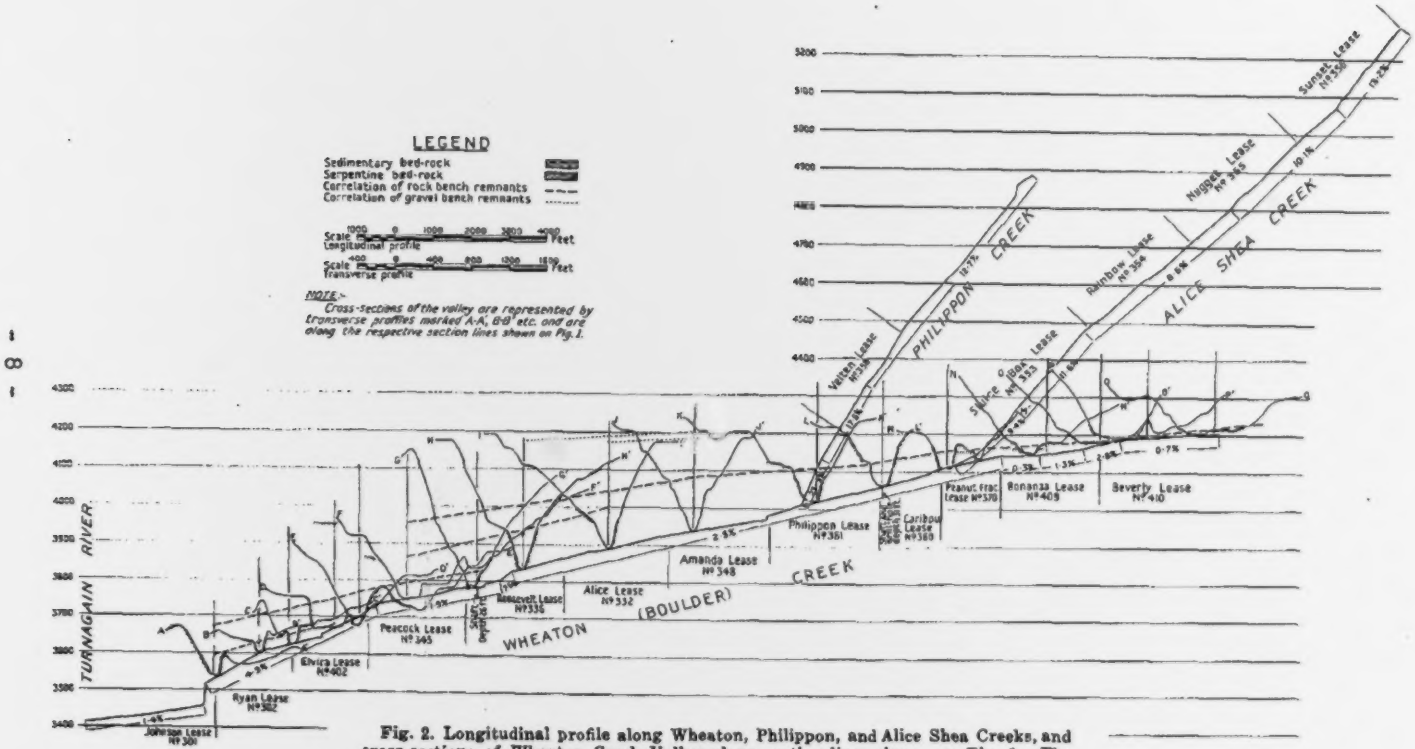
LEGEND
Sedimentary bed-rock
Serpentine bed-rock
Correlation of rock bench remnants
Correlation of gravel bench remnants
Scale Longitudinal profile
Scale Transverse profile
Feet
NOTE:-
Cross-sections of the valley are represented by transverse profiles marked A-A, B-B etc. and are along the respective section lines shown on Fig. 1.
TURNAGAIN RIVER
WHEATON CREEK (BOULDER)
PHILIPPON CREEK
ALICE SHEA CREEK
Johnson Lease N° 301
Ryan Lease N° 302
Elvira Lease N° 402
Peacock Lease N° 365
Roosevelt Lease N° 336
Alice Lease N° 332
Amanda Lease N° 348
Philippon Lease N° 361
Caribou Lease N° 369
Peanut Frac Lease N° 378
Bonanza Lease N° 409
Beverly Lease N° 410
Valton Lease N° 358
Rainbow Lease N° 354
Spruce Lease N° 353
Nugget Lease N° 345
Sunset Lease N° 338

Fig. 2. Longitudinal profile along Wheaton, Philippon, and Alice Shea Creeks, and cross-sections of Wheaton Creek Valley along section-lines shown on Fig. 1. The figure shows the correlation of gravel and rock bench remnants.

Benches. Benches are a prominent and important feature of the stretch of Wheaton Creek valley that lies down-stream from a point a mile south of the mouth of Alice Shea Creek (see Figs. 1 and 2). North of the mouth of Philippon Creek, on the Amanda, Alice and Roosevelt leases, there are high gravel benches on both sides of the creek and from 200 to 250 feet above it. These bench remnants, though not continuous, may be correlated on one side of the creek or the other, but not from one side to the other. They extend for a mile or more along the sides. Rock bench remnants are more important, though not always more prominent than the gravel benches. These have been observed and correlated from Wheaton Creek Falls, southward along the creek to a point a mile south of the mouth of Alice Shea Creek. The rock bench remnants range from a few feet to as much as 200 feet above the creek, and may be bare rock, or covered with a few feet of gravel or with glacial boulder-clay. In Fig. 2, which is a longitudinal profile of Wheaton Creek and its tributaries, Philippon and Alice Shea Creeks, transverse profiles are drawn at various points along the valley. The bench correlations are made on this basis. The benches are correlated on four separate and distinct levels, each of which represents a stage in the down-cutting of the stream. The rock bench remnants, which a mile or so above Alice Shea Creek, are at or just above creek-level, are correlated with down-stream remnants that are progressively higher than the creek. It is apparent that this upper level is the down-stream extension of the Wheaton Creek valley-bottom that lies south of a point a mile up-stream from the mouth of Alice Shea. This, the highest level, with a grade of 1.2 per cent., represents the oldest valley-bottom of Wheaton Creek, and it is interesting to note that straight line projections of the upper courses of both Philippon and Alice Shea Creeks are only slightly above it.

A second lower correlated level extends through the Alice, Roosevelt and Peacock leases. The farthest down-stream point to which a correlation could be made is a small rock bench below the falls on a small side creek entering Wheaton just south of the Barrington camp.

A third, more important level, is the correlation of an inconspicuous rock bench at Bobner's camp, with the sand and gravel-covered rock bench lying 25 to 30 feet higher than and to the east of Barrington's camp, and with the bare high rock bench remnants flanking the lower canyon-section of Wheaton Creek.

A fourth, and lowest level, is the correlation of the low rock bench remnants that lie along Wheaton Creek in the

lower canyon-section between Wheaton Creek Falls and Wheaton's camp. This lowest level is important because it appears to correlate with the presumed bed-rock of a dry, drift-filled gulley, which extends southward from Wheaton's camp and along which the trail runs from Wheaton's camp up the valley (see Fig. 1). The direction of the dry gulley is significant, inasmuch as it heads towards, but is considerably below, the rock bench east of Barrington's camp. It probably indicates that a buried former stream channel lies east of, and at a lower elevation than, the rock bench. The filled channel probably approaches the present stream about a thousand feet south-eastward from Barrington's camp, at a point east of a bed of limestone that outcrops along the trail. Kettle-holes on the surface indicate that the channel is filled with glacial material.

The valley of Wheaton Creek has widely-flaring sides south of a point a mile south of the mouth of Alice Shea Creek. The bottom is wide and bed-rock is exposed in many places, but there are no rock bench remnants and only occasional low gravel benches on the sides. The creek meanders on a gentle grade, in one place by a drift ridge and in another by a pot-hole lake. Drift is not deep in the valley-bottom, most of it lies along the sides.

Tributaries of Wheaton Creek. Philippon Creek, a short steep tributary of Wheaton joins it from the east about 1,000 feet south of the No. 1 post of the Philippon lease (No. 361). The creek rises steeply (see Fig. 2) from its mouth but flattens towards its head. The creek-valley is widely flaring. In its lower stretch the creek flows in a shallow canyon partly incised in bed-rock whereas towards its head the creek flows over a thin veneer of glacial material. It is significant that the down-stream projection of the flatter profile of the upper part of the creek is only 10 feet above the highest bed-rock bench correlation along Wheaton Creek.

Alice Shea Creek is the one important gold-producing tributary of Wheaton. It rises at the foot of Mt. Shea (see Fig. 3) flows northward for a mile and a half, then turns westward and joins Wheaton Creek on the Peanut Fraction (lease No. 370) about 4 1/2 miles south of the Turnagain.

In its lower course, on lease No. 353, Alice Shea Creek flows in a narrow rock canyon having walls 50 to 75 feet high. Up-stream from the canyon the creek is incised below the bottom of a flaring valley and is flanked by drift covered rock benches and walls 15 to 25 feet above creek-level. Through the canyon, Alice Shea Creek flows on an average grade of 11.6

per cent. (see Fig. 2). The grade above the canyon flattens to 8.6 per cent. for 1,200 feet, then steepens gradually to 13.2 per cent. at the head. At various points along its course the creek drops over low falls or short steep sections as much as 15 feet high. Between them there are stretches from 200 to 400 feet long where the creek flows with a uniform grade, on bed-rock or over only a few feet of gravel, and between low confining walls 50 feet apart.

Glacial Features. At present the only glacial ice near Wheaton Creek is a small glacier on the north side of King Mountain at the head of one of the forks of Ferry Creek. There is none within the drainage basin of Wheaton Creek. Nevertheless, there are certain erosional and depositional features that indicate the former presence of glacial ice.

The upland areas and mountains, up to 6,500 feet elevation, lack ruggedness. King Mountain is the only one rising above that elevation and much of its ruggedness is due to the steep-walled cirques on its northern flanks. Elsewhere the valley-heads gradually steepen but do not terminate in large cirques. Rock surfaces above the valley-bottom are smooth and rounded and in places are free from any drift cover. On the ridge to the west of Wheaton Creek and on top of the ridge between Philippon Creek and the Turnagain, there are glaciated rock surfaces on which the glacial striae trend northeastward. Most ridge tops, knolls and peaks up to 6,500 feet are noticeably rounded.

The valley of Wheaton Creek south of the mouth of Alice Shea Creek is straight, fairly steep-sided and almost trough-like. The hanging relationship of several small tributaries and the absence of prominent ridges running down to the valley-bottom give it a typical glacial form.

The valley north of the mouth of Alice Shea Creek was glaciated as well but in some sections not down to the level of the present creek. Glaciated surfaces are seen on rock bench remnants which have been correlated with the lowest level and other bench remnants are covered with drift. Nevertheless the canyon between Barrington's and Wheaton's camps, and the canyon below the lowest rock bench level were not glaciated. They are clearly the result of post-glacial stream cutting.

The bottom of Turnagain River in the eastward-flowing stretch near the mouth of Wheaton Creek is notable for its innumerable lakes. Many of them are only a hundred yards across, but others may be a mile long or more. The valley-bottom is

filled with drift and the lakes, some of which have no drainage outlet, are surrounded by irregular drift ridges. The lakes are water-filled kettle-holes. Dry kettle-holes were seen on the bench to the south-east of the mouth of Wheaton Creek and at 3,800 feet elevation on the gravel bench south-east of Barrington's camp. These latter are close to the head of the gulley that runs southward from Wheaton's camp. Another kettle-hole lake is in the bottom of Wheaton Creek valley about 2,200 feet south of the initial post of the Beverly lease (No. 410). On the same lease there are irregular drift ridges though none are recognized as terminal moraines.

Glacial erratics are widespread in the Wheaton Creek drainage area. They are in the bottom of the valley as well as on the top of Mt. Shea (6,533 feet). In size, they range from small cobbles to large boulders weighing many tons and in variety, they include a number of rock types foreign to the underlying rock of the area. These erratics comprise boulders and cobbles of, red to purple volcanic tuff and breccia, varieties of fine granular greenstone, brown and reddish-brown vesicular lava, grey granite and diorite, pink syenite (seen on top of the ridge east of the head of Alice Shea Creek) and an unusual chert pebble conglomerate (a boulder seen on the ridge south of Philippon Creek). A large proportion of the erratics however, are boulders of serpentine, a rock that outcrops in many parts of the area.

DESCRIPTIVE GEOLOGY

Bed-rock in many places is obscured by a widespread veneer of drift. Outcrops for the most part are along the creek canyons and on the ridge tops and higher summits. The accompanying geological map (Fig. 3) and Fig. 1 show areas where bed-rock is exposed and where it was observed during the course of the field work. Fig. 3 is compiled from Map 381A previously published by the Department of Mines and Resources, Ottawa, together with extensions and corrections made during the summer of 1939. The eastern limit of map 381A is the 129th meridian. Wheaton Creek and the topography and geology east of that meridian were added by the field work of 1939. In general, Fig. 3 shows outcrop areas of the various rocks, and indicates the approximate boundaries of the various formations. All outcrop areas that were observed are shown on the plan, but blank areas indicate that outcrops are absent or that the area was not traversed.

Sedimentary series. The oldest rock in the area is a conformable series of sediments containing at least one volcanic member. The sedimentary succession comprises fine

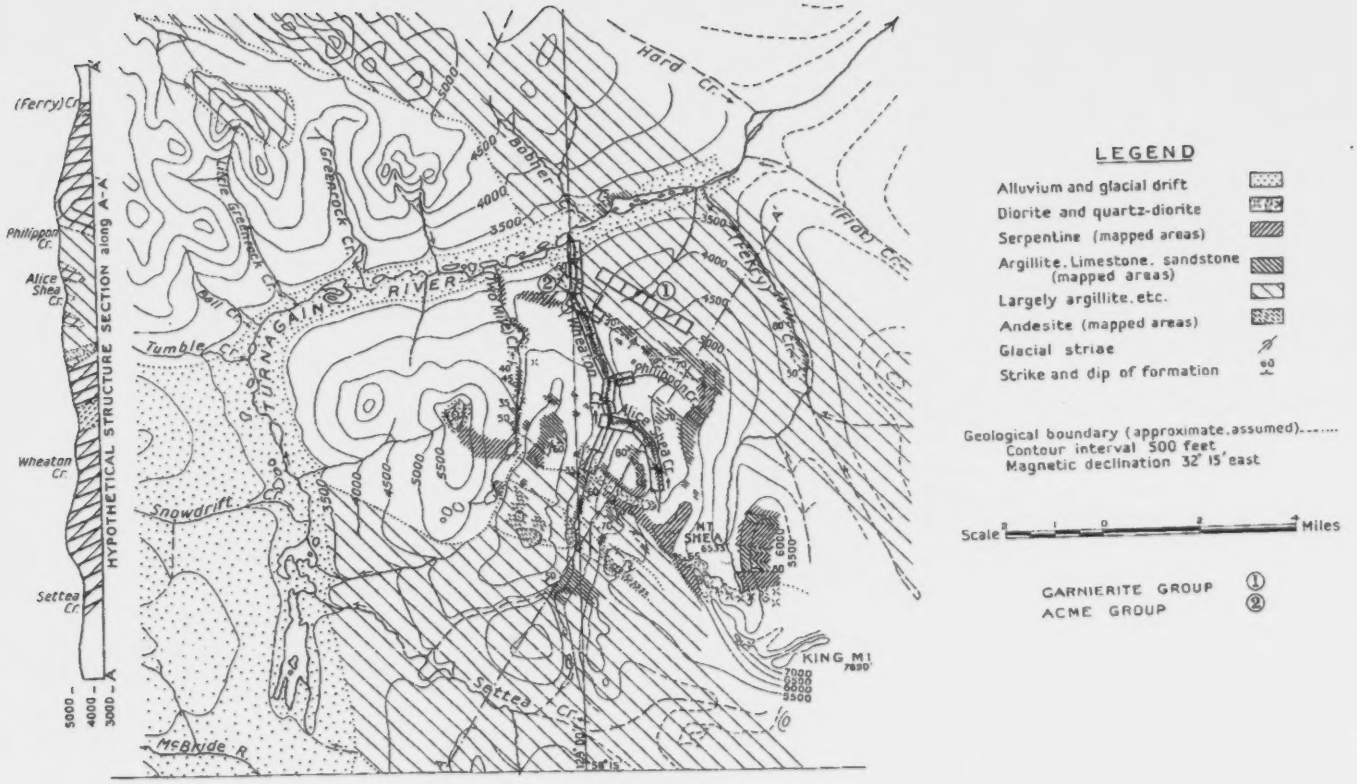

Fig. 3. Geological map of Wheaton Creek and adjoining country.

black slate with a moderately well developed cleavage, black slaty argillite, thin beds of fine, grey sandstone, and massive light grey limestone. The limestone occurs in the other sediments as beds ranging from 5 to 200 feet in thickness. One bed of limestone about 60 feet thick crosses Wheaton Creek and forms the bed-rock of the falls. Another member is a belt of green andesitic flows, which outcrops in a band 3,000 to 5,000 feet wide south of the lake towards the head of Wheaton Creek. The andesite is intercalated with quartz mica schist and contains short lenses of limestone up to 50 feet wide. The included limestone is fine grained in places and coarsely crystalline in others.

The sedimentary rocks outcrop in two main belts. One large area, mostly underlain by sediments, lies to the north and north-east of Barrington's camp. Another large area extends southward from a point about 1 1/2 miles south of the mouth of Alice Shea Creek. Both these areas (see Fig. 3) are believed to be almost entirely underlain by the sedimentary and volcanic succession.

Other large and small sedimentary outcrop areas are shown on Fig. 3. There are large areas underlain by slate and sandy sediments along the ridge top west of Wheaton Creek, on the ridge between Alice Shea and Wheaton Creeks and on the ridges surrounding the Philippon Creek drainage basin. Other small areas observed, were only 50 to 100 feet wide, and too small to show on Fig. 3. A number of these are exposed along the bottom of Alice Shea Creek; one is about 1,500 feet wide, the others considerably less. The lengths of many sedimentary areas could not be seen because of the scarcity of outcrops. However, where these sediments occur in serpentine it is believed that they are not continuous along their strike and are completely surrounded by serpentine.

Serpentine. The most conspicuous rock exposed in lower Wheaton Creek valley is serpentine. On a weathered surface its colour may be light greenish-grey, yellowish-buff, greenish-yellow, bright yellowish-green or greenish-black. Some weathered surfaces have a warty appearance resulting from the resistance to weathering of small magnetite grains. In places the serpentine is massive, in others, it is intensely sheared. Some sheared zones in the serpentine have a spheroidal weathering almost like pillow structure in lava. At one point, on the north slope of Mt. Shea, the serpentine appears porphyritic. This results from the almost complete serpentinization of the rock, partly altered pyroxene being left as pseudophenocrysts. In general, the rock, under the microscope, is seen to be composed largely of serpentine (antigorite), and

occasional remnants of pyroxene. Though no olivine is seen, the serpentine is believed to be derived from the alteration of an intrusive peridotite.

Map 381A of the Department of Mines and Resources, Ottawa, shows a wide band of serpentine extending to the northwest of Wheaton Creek. Along the creek, serpentine outcrops in a belt about 3 miles wide. The northern serpentine--sedimentary contact is at Barrington's camp and the southern about a mile and a half south of the mouth of Alice Shea Creek. Bright green serpentine was seen on ridges and peaks that lie far to the south-east of Wheaton Creek.

There are numerous outcrops of sediments within the general outcrop area of the serpentine belt. The serpentine, inasmuch as it is an altered intrusive rock, is presumed to enclose the sediments not only along their strike but at depth. Although nowhere was the downward extension of the sediments actually seen, their depth, no doubt, would be roughly proportional to their areal extent.

Igneous rocks. Intrusive igneous rocks outcrop in several areas. One is on the summit and north-easterr slope of the mountain west of Two-Mile Creek. The rock there is massive, grey, granular quartz-diorite with almost equal amounts of light and dark minerals. It is partly altered to chlorite and epidote.

Another area of intrusive rock extends westward from the head of Alice Shea Creek, across the top of the ridge and down into the bottom of Wheaton Creek. At its widest it is about 1,200 feet across. The rock is a medium to dark grey, massive though considerably altered diorite. Similar rock was observed over a fairly large area to the west and north-west of King Mountain and although the peak was never climbed, it is believed to be diorite as well.

Both the diorite and quartz-diorite intrude serpentine, but nowhere were they seen in contact with the sediments. The serpentine ordinarily is greenish-black, but for several hundred feet from a diorite or quartz-diorite contact is a bright yellowish-green.

Dyke rocks, though changeable from place to place in granularity, are light-coloured, almost devoid of dark minerals and composed essentially of quartz and feldspar. They may generally be referred to as aplite. They range in width from 2 to 10 feet. One dyke intrudes slate on Wheaton Creek about a mile and a half south of the mouth of Alice Shea

Creek. Another was seen in slate on the top of the ridge north of Philippon Creek. Several were seen along Alice Shea Creek where they intrude both slate and serpentine.

Structure. Apart from areas of intrusive rocks, the other two, serpentine and sediments, are in belts trending north-westward. The serpentine is flanked by sediments. Although there are local small variations, the general strike of the sediments is north-westward. The dips at the head of Wheaton Creek are moderate (40 to 50 degrees north-eastward), but elsewhere the sediments dip fairly steeply (60 to 80 degrees) either to the north-east or south-west. In attempting to work out the general structure of the sediments no stratigraphic horizon was found that could be traced from place to place, as both the limestone and volcanic members are discontinuous and the general succession is not defined clearly enough to be of much value. The structure-section (see Fig. 3) is the result of strike and dip observations and, therefore, must be regarded as provisional. It is believed that an anticlinal axis lies to the north-east of the north-eastern serpentine-sedimentary contact, and a synclinal axis to the north-east of the south-western contact. Drag-folds with a closure of not more than 10 feet were seen in the slate on the limbs of the folds.

Peridotite, now altered to serpentine, intrudes the folded sediments. To the west of Wheaton Creek the serpentine contact cuts directly across the strike of the sediments. Elsewhere however, it is conformable not only along the strike of the sediments, but apparently part of the way down the dip. Even along the margins of small sedimentary areas within the serpentine the attitude of the margins is similar to that of the bedding of the sediments, though undoubtedly, the sediments must be bottomed at depth. Tongues of serpentine intrude limestone on top of the ridge west of Alice Shea Creek. Apparently the peridotite was intruded along the axis of and to the north-east of a syncline in the slate. The slate does not appear to have been disturbed during the process. Sedimentary areas within the serpentine are erosion remnants of a once continuous, folded sedimentary cover.

Unconsolidated Sediments. Unconsolidated material is widespread in the area around Wheaton Creek, although there are few exposures where the nature of the material may be seen. Most of it is Pleistocene, either glacial or fluvio-glacial. Some Recent deposits are derived from the reworking of glacial material by post-glacial streams.

The most widespread, is a veneer of blue-grey boulder-clay

which masks bed-rock in the valley-bottom and extends far up the valley-sides. In general the boulder-clay is thin, though one 50-foot bank on Wheaton Creek, lies above a rock bench correlated with the upper bench-level. The bottom of the Turnagain valley is filled with glacial drift, which must be greater in depth than the 65-foot sounding in one of the kettle-hole lakes. The boulder-clay and glacial drift are unweathered, they cover most of the other glacial material, and presumably were deposited at the time of the last ice advance.

Bed-rock beneath Wheaton Creek on the Peacock lease (No. 345) is shown by Barrington's drag-line cut to be overlain by 4 to 6 feet of flat-lying, thinly-bedded, buff clay. The clay in turn is overlain by 10 to 20 feet of grey to buff unsorted clayey gravel. Some boulders in the gravel are as much as 10 feet in diameter. A few feet of fairly clean, rudely-sorted sand and gravel lie on top. This latter material was probably laid down by the present creek. The underlying fluvio-glacial clay and clayey gravel, because of their composition and their position below the lowest boulder-clay, are believed to be interglacial. There is, however, no boulder-clay that records an early ice advance.

Up-stream from Barrington's camp, F. Bobner sank a 26-foot shaft in the bottom of the creek on lease No. 336. The shaft was abandoned before bed-rock was reached. The material in the shaft is clean sand and gravel containing many boulders foreign to Wheaton Creek valley. No boulders encountered were more than 2 to 3 feet across. The gravel is believed to be interglacial.

Another shaft was sunk in the bottom of Wheaton Creek opposite Faherty's cabin on lease No. 360. From the bottom of the 12-foot shaft a drill-hole was put down to a depth of 31 feet. It is reported that bed-rock was not reached. At this point, Wheaton Creek again is shown to be flowing over a gravel-fill which presumably is interglacial.

The various rock bench remnants along Wheaton Creek are covered with glacial boulder-clay or with sand, clay, or gravel laid down during the post-glacial down-cutting of the present creek.

Other benches at elevations above the rock bench remnants are composed of unconsolidated material which just below the surface is seen to be sand or sandy gravel but there is no indication of the composition of the bulk of the underlying material. The position of the benches indicates that they are late glacial or post-glacial. Inasmuch as the benches do not

correlate from one side of the valley to the other, and in places their surfaces are irregularly pitted, it is suggested that the material was deposited by streams flowing beside a stagnant ice-tongue. As the ice surface and lateral streams were lowered, the benches were left at various elevations along the valley-side. There is no suggestion that they were formed from a deep valley-fill during the successive stages of post-glacial stream down-cutting.

The surface gravel in the bottom of Wheaton Creek and the gravel overlying bed-rock to a depth of 6 to 10 feet in the lower canyon were deposited by the present creek. They have resulted from the reworking of glacial material.

Grey boulder-clay almost completely covers the widely-flaring sides of Alice Shea Creek valley. The boulder-clay lies directly on the bed-rock forming the low rock benches flanking the creek. Bed-rock in the bottom of the creek, however, is overlain by 1 to 3 feet of Recent gravel, which was deposited by the present creek and was derived from the reworking of glacial material during post-glacial down-cutting.

Cemented gravel was observed in various places in the bottom of the valley of Wheaton Creek. It is particularly prominent on the canyon-sides in the stretch of creek covered by the Alice, Amanda and Philippon leases. The farthest point up-stream where cemented gravel was observed is just above the mouth of Alice Shea Creek. The gravel is fairly well sorted, contains layers and lenses of sand, is composed of many rocks foreign to Wheaton Creek drainage area, and is firmly cemented by calcium carbonate. All exposures of cemented gravel are below the line of the upper bed-rock bench remnants. On the Alice, Amanda and Philippon leases the bedding of the gravel is almost horizontal. In places on the steep serpentine canyon wall the gravel outcrops are 20 feet high and 6 feet thick. Evidently the gravel was cemented before the creek cut to its present position. The absence of cemented gravel boulders and blocks in the creek-bottom indicates that only a narrow shell lying along the side-walls and bottom was cemented and not the whole gravel-fill. The cement was probably deposited by carbonate-bearing water derived from the weathering of adjacent serpentine. The cemented gravel is overlain by boulder-clay and is believed to be interglacial.

Cemented gravel was encountered in the drag-line excavation in the creek-bottom west of Barrington's camp, where it lies in patches on flat-lying, thinly-bedded clay. The gravel is similar to the clayey gravel above. This cement which at times makes excavating difficult has no connection with simi-

lar material lying farther up-stream. The cementation probably is slowly taking place at the present time and the cemented gravel, for that reason, may contain placer-gold. The numerous limestone beds in the surrounding slate are an ample source for carbonate-charged ground water.

Another patch of cemented gravel lies on sloping bed-rock on the side and bottom of a ground-sluice cut on the Amanda lease (No. 348). On Alice Shea Creek, down-stream from Shea's camp, boulder-clay, resting on bed-rock on the sides and bottom of the creek, is firmly cemented with calcium carbonate.

PHYSIOGRAPHIC HISTORY.

In general, the Tertiary era in the area around Wheaton (Boulder) Creek was a time of long-continued erosion. No Tertiary volcanisim such as that to the south and west is evident near Wheaton Creek. During the Tertiary, streams dissected the old land surface and by late Tertiary had produced a topography of mature relief. Towards the close of the Tertiary, the relief was much the same as it is now, the valleys were wide and flaring, the drainage system was well organized, and the streams were flowing on an established grade. The bed-rock profile of Wheaton Creek at that time is represented by the highest bed-rock bench correlation on Fig. 2.

Turnagain River was rejuvenated, presumably near the close of the Tertiary and prior to the Pleistocene, and began incising its channel. The lowering of the baselevel rejuvenated all the tributary streams and they in turn began to erode actively. Naturally, erosion would first start at the mouths of the tributaries and in the course of time progress towards their heads. However, because of the difference in volume between the parent stream (the Turnagain) and its tributaries, the Turnagain might be expected to cut the faster. Consequently, as downward erosion in the lower stretches of the tributaries could not keep pace with the Turnagain, those stretches would not be graded to the level of the parent stream and might be expected to be exceedingly steep or even drop over falls near their mouths.

The three lowest bench correlations on Fig. 2 are taken to represent stages in the late Tertiary down-cutting of Wheaton Creek. The northward projection of the lowest rock benches in the down-stream canyon-section of Wheaton Creek intersects the Turnagain about 100 feet above its present level. The bed-rock bottom of Turnagain valley is at least 65 feet below the present river. Consequently, even in the late Tertiary, there must have been falls or at least a very steep

stretch near the mouth of Wheaton Creek. The alternative explanation, of course, is to attribute the over-deepening of the Turnagain Valley to erosion by glacial ice, but the low grade of Turnagain valley and absence of high ice gathering ground does not support that view. In the absence of any confirmatory data the writer prefers to explain it by pre-glacial stream action. The evidence for rejuvenation has been cited, consequently, over-deepening of the main stream or a hanging relationship of the tributaries appear to be a logical result of the process.

On the Peacock lease (No. 345), the southward projection of the lowest rock bench correlation is below the level of the present creek. Farther up-stream the projection is close to creek-level, but, up to the mouth of Alice Shea Creek, remains below. This is interpreted as meaning that in late Tertiary there was a canyon along Wheaton Creek, comparable to the present one. Furthermore, it is significant that the projection of the rock bench correlation southward from Wheaton's camp corresponds with the mouth of a dry, southward-trending gulley. The projected line being below creek-level on the Peacock lease indicates in all probability that a buried late Tertiary channel lies to the east of Barrington's camp. The channel eventually joins Wheaton Creek and coincides with it at a point less than 2,000 feet south from the camp.

The late Tertiary stream rejuvenation and down-cutting was followed by an advance of glacial ice during the Pleistocene. The pre-glacial topography and drainage was modified to a slight extent by glacial ice. It is believed that there were two ice advances separated by an interglacial stage. Consequently it is not possible to discriminate between the erosional features of the two ice advances. However, the erosion, in the valley-bottom, by neither was sufficient to disperse gold which is believed to have been set free and partly concentrated during the Tertiary. Depositional features are clearly the result of the last ice advance.

Ridges and summits up to 6,500 feet elevation are rounded and have a scattering of glacial erratics. The ice at its maximum extent must have reached to at least that height. High jagged peaks above 6,500 feet elevation do not necessarily imply that they stood above the ice level, and it is possible that King Mountain (7,890 feet) was covered with glacial ice.

Glacial erratics of various kinds are scattered over the high points of the area but insufficient knowledge of the surrounding geology prohibits positive deductions regarding the

direction of ice movement. Directions of glacial striae on high ridge tops on the west and east sides of Wheaton Creek are north 37 degrees east and north 42 degrees east respectively. Previously, Hanson and McNaughton[1] claimed that the direction of the last ice movement was northward; whereas, Johnston and Kerr[2] state that ice moved southward across Dease Lake area. The writer is inclined to think that the direction of the last ice movement was northward. Whatever may have been the direction of the ice-cap movement, the last ice moved northward down Wheaton Creek valley. Ice, furthermore, appears to have moved in a north-easterly direction from the head of Two-Mile Creek towards Wheaton Creek at Barrington's camp. The rock surfaces were smoothed, striated, and often polished by glacial ice. With the waning of the ice-age a mantle of drift was deposited in the valley-bottom and up the sides. Probably the disappearance of the last glacial ice in both Turnagain valley and Wheaton Creek valley took place by the melting of more or less stationary ice, rather than by the retreating of an ice-front. The kettle-lakes of the bottom of Turnagain valley and the benches along the sides are an expression of this condition. At the same time, high gravel benches along the sides of Wheaton Creek valley were formed from deposits of sand and gravel of streams flowing beside the stagnant ice mass. Successive benches were formed at stages in the lowering of the ice-level, but the valley was never completely filled with glacial debris. Consequently, one would not expect to correlate benches from one side of the valley to the other. The kettle-holes south-eastward from Barrington's camp were formed by the slumping of glacial material subsequent to the melting of solitary blocks of ice buried in drift.

During the interglacial stage, when the country was more or less free from glacial ice, an actively eroding creek flowed in the bottom of Wheaton Creek valley. This creek is believed to have cut a channel in bed-rock below the present level of Wheaton Creek. In its course southward from Barrington's camp the level of the interglacial stream may have closely approximated that of the last pre-glacial level. It is thought that from the Peacock lease (No. 345) northwards to the Turnagain the interglacial channel diverges from the present and pre-glacial courses of Wheaton Creek. The interglacial channel is believed to lie buried to the west of Wheaton Creek

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1 - Bureau of Economic Geology, Memoir 194, 1936, page 3.

2 - Geological Survey, Canada, Summary Report 1925, Part A, page 47A.

by the head of the canyon at the southern limit of the Elvira lease (No. 402). No further northward extension of the channel is known beyond the point already mentioned.

Two bed-rock channels are believed to be on the Peacock lease (No. 345). One, a buried late Tertiary channel probably lies to the east of and below the level of Barrington's camp. The second bed-rock channel lies beneath creek-level to the west of the camp. The latter channel is filled with bedded clay and clayey gravel. In order to avoid the difficulty of explaining a pre-glacial diversion of Wheaton Creek and to avoid the postulation that the entire rejuvenation of the Turnagain River and its tributaries was interglacial, this second bed-rock channel is considered to be interglacial.

Bedded clay and clayey gravel were deposited in the bottom of the channel after the completion of the bed-rock channel cutting and, just prior to the re-advance of the ice. This was followed by the last glacial ice advance.

Down-cutting by Wheaton Creek has been continuous since the wane of this last ice advance. The wasting of the ice gave greater volume to Wheaton Creek and its erosive power was made effective by the lowering and disappearance of ice in the Turnagain valley. In the upper stretch of Wheaton Creek valley the creek has re-occupied and re-excavated the valley formerly occupied in pre-glacial and interglacial time; but for a stretch north of the Peacock lease, the creek coincides with neither the pre-glacial nor interglacial channels. In its post-glacial downward cutting the creek cut a canyon between the southern limit of the Elvira lease (No. 402) and Wheaton's camp. North of the camp the creek coincides with an earlier channel and has re-excavated and cut below the pre-glacial course of the stream.

LODE-DEPOSITS

Quartz veins and stringers outcrop in many places around Wheaton (Boulder) Creek. Many are narrow stringers or veinlets running parallel to the formation, others cut across it. Although most of them are narrow, some attain a width of 3 feet but, as a general rule, the outcrops of even the largest can not be traced far before they disappear or are covered with over-burden.

The quartz veins are found largely in the sedimentary series. The slate and schist north of the lake towards the head of Wheaton Creek contain many stringers; other veins and stringers were seen in the slate on the ridge top west of

Wheaton Creek, on the ridge west of Alice Shea Creek, and on the ridges to the north and south of Philippon Creek. In fact, there are stringers in most of the sedimentary areas. There are some, up to a foot wide, in a limestone bed on the Turnagain slope of the ridge north of Philippon Creek. Other veins are in outcrop areas of the diorite and quartz-diorite intrusives. None, however, were at any time seen in serpentine. Even quartz veins in the diorite on the ridge west of Alice Shea Creek ended at the contact of the serpentine with the intrusive.

The veins in general are narrow, many being less than 2 feet wide. The stringers in the slate and schist are entirely quartz; whereas, some of the wider veins are composed largely of white milky quartz together with a small amount of calcite or ankerite. Many of the veins lack sulphide mineralization, but a few contain a small amount of pyrite in scattered grains and patches. Pyrite was the only sulphide seen in the quartz veins.

Samples were taken of the best mineralized material from five separate veins. The assay return in each instance was nil for both gold and silver. Other samples of oxidized vein-quartz were roasted, crushed and panned in the field but yielded no trace of gold.

A 22-inch quartz vein is partly exposed in an open-cut at the south end of the bench, about 900 feet south of Barrington's camp. The vein appears on the contact between serpentine and the sediments that lie to the north. The quartz is white, watery-looking, sparsely mineralized with pyrite, and is broken and oxidized near the surface. An assay of a sample of this quartz yielded nil for gold and silver. Some of the oxidized material from the vein and overlying debris was concentrated by washing in a gold pan; even the concentrates assayed nil for gold.

A group of six mineral claims, the Acme Nos. 1 to 6, was staked by H. Ficklin to cover the area around the above mentioned vein exposure. The group was staked along location-lines running north-westward, parallel to the strike of the slate and argillite which it covers. These claims straddle Wheaton Creek to the north of the serpentine-sedimentary contact near Barrington's camp (see Fig. 3).

Very little work has been done on the claims, and it is understood that no veins containing gold have been found.

During the summer of 1939 considerable interest was

aroused at Wheaton Creek and elsewhere by the reported discovery of nickel-bearing rocks. Ten mineral claims were staked along the outcrop of a rock containing a bright-green, micaceous mineral. The mineral was claimed to be garnierite, but was later identified as a green chromiferous mica, mariposite. The pure mineral assays 3.2 per cent. chromium and 0.32 per cent. nickel.

The 10 mineral claims, the Garnierite Nos. 1 to 8 and the Lucky Shot Nos. 1 and 2, were staked by F. Bobner and George Lemon, along the outcrop of a bed mineralized with mariposite (see Fig. 3). The outcrop is formed by a 50-foot bed of limestone interstratified with argillite. In numerous places the bed is cut by narrow reticulating quartz veins and near them, the rock is largely buff or red-brown weathering ankerite, which is mineralized along narrow stringers and in small irregular patches with bright green mariposite. The ankeritic alteration and mariposite mineralization appear to be confined entirely to the limestone bed, as none of the adjoining argillite is similarly changed. A sample of selected material abundantly mineralized with mariposite, taken from the outcrops on the claims, assayed: Nickel 0.14 per cent. and chromium 0.07 per cent.

The andesitic volcanics that outcrop in a belt crossing Wheaton Creek valley near the lake by its head contain a number of small lenses of grey crystalline limestone. Several lenses outcrop in the bottom of the valley just south of the lake. They are cut by numerous narrow intersecting quartz veins and are altered to grey coarsely crystalline ankerite. The ankerite weathers to a deep red-brown and is mineralized with narrow stringers and small patches of mariposite. The mariposite is bright or blackish green but on weathering becomes apple green in colour. The narrow quartz stringers frequently contain small flakes of mariposite and grains of ankerite. A sample of ankerite, abundantly mineralized with mariposite assayed: Nickel 0.15 per cent. and chromium 0.1 per cent.

Another outcrop of mariposite-ankerite rock was seen on the ridge-top west of Wheaton Creek. Numerous float boulders in the stream-bottoms indicate that other occurrences exist.

Float boulders of chromite have from time to time been found in various places along Wheaton Creek, especially during the course of placer operations. No chromite, however, has yet been discovered in place, but the boulders have undoubtedly been released from some deposit within the serpentine. A sample of chromite from a large boulder on the

Elvira lease (No. 402) assayed chromic oxide 47.5 per cent. In spite of this high chromium content, the present exceedingly high transportation charges would make it uncommercial to mine chromite should a deposit be found on Wheaton Creek.

PLACER-GOLD DEPOSITS

History and Production. Dawson[1] reports that in 1874, prospectors found coarse gold on creeks tributary to the headwaters of Turnagain River. In subsequent years parties of prospectors went into the headwaters of the Turnagain, but did not find gold-bearing gravel worth working.

In 1932 a party of about 10 prospectors went into the Turnagain country to prospect the creeks at the head of that river. Coarse gold was found by Carl Johnson and his partner on Wheaton (Boulder) Creek just above the falls. Creek claims were first staked; later, two placer leases were staked, the Johnson lease (No. 301) and the Ryan lease (No. 302). For 1932 Carl Johnson reported a recovery of 24 ounces of gold from Wheaton Creek just above the falls. Jack Wheaton bought the Johnson and Ryan leases in 1933, and staked a third lease for himself, now lease No. 402. P. Peacock subsequently staked lease No. 345. By 1936 Wheaton Creek had been staked up to and beyond Alice Shea Creek, and Alice Shea Creek had been staked to its head.

Since 1935, when a production of 4 ounces of gold was reported from Wheaton Creek, a total of 4,348 ounces of crude gold valued[2] at $140,592.00 has been produced from Wheaton and its tributary Alice Shea Creek. Practically all the gold has come from three leases, Nos. 402, 345 and 355; and most of it has been recovered from lease No. 345. In 1936, the production was 124 ounces; in 1937, 331 ounces; in 1938, 1,400 ounces; and in 1939, 2,993 ounces. In 1937 the large nugget weighing 52 ounces 15 dwt. was found by V. Shea on lease No. 355 on Alice Shea Creek. This discovery and the finding in 1938 of rich, shallow pay-gravel on the Peacock lease (No. 345), have done much to focus interest, not only on Wheaton Creek, but also on the whole Turnagain country.

Occurrence. On Wheaton Creek, most of the gold has been recovered from lease No. 345. On this lease the creek flows

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1 Annual Report, Geological Survey, Canada, Vol. III, Part 1, 1887-88, page 82B.

2 In this report crude gold is reckoned at $29.00 an ounce.

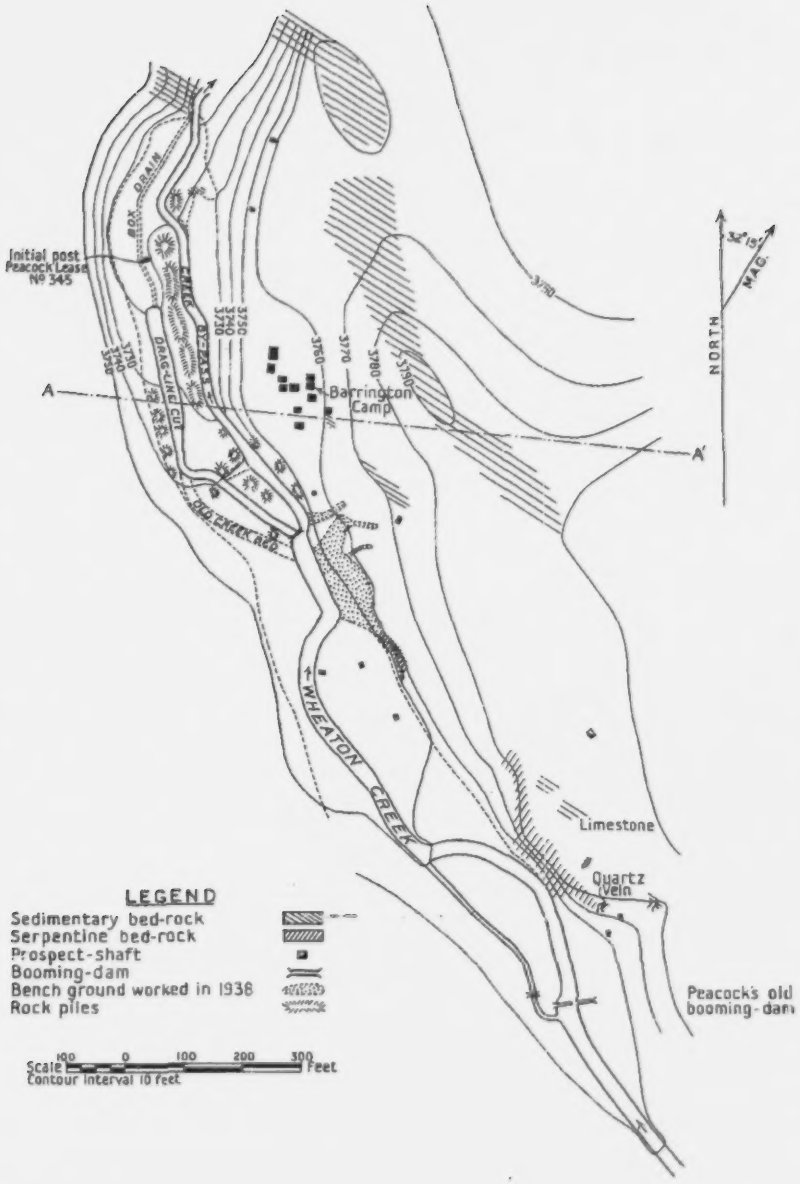


Fig. 4. Detail map of Wheaton Creek at Boulder Creek Mines, Limited operation on the Peacock lease.

over clayey gravel lying above thinly-bedded clay which in turn rests on the bed-rock of an interglacial channel. Barrington's camp is to the east on a gravel bench 20 to 25 feet above the creek (see Fig. 4).

A rock bench, thinly covered with clay, sand and gravel lies farther east, about 40 to 45 feet above the creek. The first gold recovered by Peacock was from a ground-sluice cut in the bottom of the creek beside the low gravel bench. The gold in the clayey gravel, was recovered largely because the ground-sluice cut was bottomed by firmly-cemented gravel or thinly-bedded clay. Bed-rock was reached only at the east side of the booming-dam; there was none in the bottom of the cut. Apparently bed-rock slopes steeply westward beneath the creek.

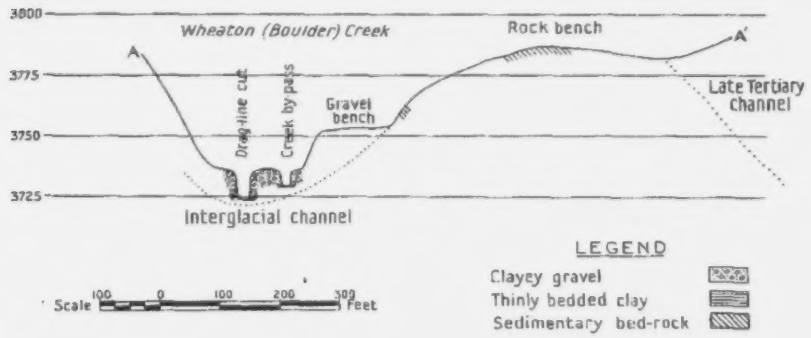


Fig. 5. Cross-section along section-line A-A on Fig. 4, showing bed-rock channel beneath Wheaton Creek on the Peacock lease, and probable late Tertiary channel lying to the east of the rock bench.

Later, in the autumn of 1938, rich pay-gravel was found at the south end of the lowest gravel bench (see Fig. 4). It is reported that in about 6 weeks gold valued at about $12,000.00 was recovered by hand-shovelling from about 11,000 square feet of ground. The surface sloped upward from the edge of the creek to a narrow bench intermediate in level between the low gravel bench on which Barrington's camp is built and the rock bench to the east. The gold was in clayey gravel within 2 to 3 feet of the sloping surface whereas similar gravel beneath is barren. When the ground was worked only the top gravel was shovelled into the sluice-boxes and bed-rock was encountered only at the extreme southern end of the workings. The pay-gravel was followed and worked up to the edge of the intermediate bench.

All the work done by Peacock on lease No. 345, prior to

1939, was either ground-sluicing or booming in the creek-bottom, or hand-shovelling of the gravel beside the creek. S. C. Barrington and associates acquired lease No. 345 in the autumn of 1938, and in the following year they installed a drag-line shovel and moveable sluice-box which enable them to work the gravel beneath the creek. Gold was then recovered from the interglacial channel beneath Wheaton Creek (see Fig. 5) from the top of the bedded clay lying on bed-rock, and in the clayey gravel directly above the clay. The gold is erratic and does not seem to follow any well-defined pay streak. Most of it, however, appears to be on the eastern side of the channel, parallel to the low-lying benches. Bed-rock beneath the clay was never reached and whether or not there is gold on it, is unknown.

J. Wheaton worked short stretches along Wheaton Creek on leases Nos. 402 and 302, and recovered placer-gold below creek-level in the lower canyon of Wheaton Creek. The gold is on bed-rock in and beneath as much as 8 feet of Recent gravel. In the autumn of 1939 several men, under a lay-agreement with Wheaton, were working on lease No. 402, above creek-level on the eastern side, and were recovering gold from gravel above bed-rock at the northern end of the dry gulley opposite Wheaton's camp. Work was started where the dry gulley enters the canyon of Wheaton Creek and an open-cut was advanced southward along it. The gravel was sufficiently rich to make a hand-shovelling operation profitable.

Although considerable prospecting and development work has been done on placer leases on Wheaton Creek south of lease No. 345, no pay-gravel has yet been found. F. Bobner sank a 26-foot shaft about 300 feet south of the No. 1 post of the Roosevelt lease (No. 336) but did not reach bed-rock beneath the creek. The overlying gravel when panned yielded some black sand and only a few small specks of gold. Previously, Bobner had found a few pieces of coarse gold on sloping bed-rock on the side of his ground-sluice cut.

On the Alice lease (No. 332), V. Shea put in a booming-dam and cleaned out a ground-sluice cut, but, because of the depth of gravel and the low creek grade, could not reach bed-rock beneath the creek. A small amount of gold was likewise recovered from sloping bed-rock on the side of the cut, but none in paying quantity. A booming-dam was built on the Amanda lease (No. 348), and a ground-sluice cut cleaned out. Again, it was impossible to reach bed-rock beneath the creek and it is understood that no gold was recovered. Very little work has been done on the leases south of No. 348 and no pay-gravel found.

One prospector reports having recovered several pieces of coarse gold (valued from 10 to 15 cents each) from bed-rock benches south of lease No. 345. It is also reported that the cemented gravel on lease No. 332 yielded a few specks of fine gold when crushed and panned. The writer crushed and panned some cemented gravel taken directly above bed-rock, and recovered a little black sand but no gold.

Most of the gold from Alice Shea Creek has been recovered from lease No. 355. The three other leases have been prospected and coarse gold found on them. All the gold recovered so far has been from the shallow gravel overlying bed-rock in the bottom of the creek, from the top of the bed-rock, or from cracks within the bed-rock.

Bed-rock and the overlying gravel and boulder-clay in the bottom of Philippon Creek have been prospected on the one placer lease (No. 358) staked along the creek above its junction with Wheaton. Although a small amount of coarse gold is found from time to time, no pay-gravel has been discovered.

Some coarse gold, and a nugget valued at about 50 cents, are reported to have been recovered from the small unnamed creek entering Wheaton from the east just below the lake towards the head of Wheaton. No leases are staked on the creek, very little prospecting has been done, and no pay-gravel found.

So far at least, workable gold-bearing gravel is found only on leases Nos. 302, 402, and 345, at the lower end of Wheaton Creek and on the four leases on Alice Shea Creek. Inasmuch as the prospecting on the other creek leases on Wheaton Creek has not attained sufficient depth to reach bed-rock, it is unknown whether there is a concentration of gold on or near the bed-rock beneath the creek.

Character and Associations. Practically all the gold recovered from Wheaton and Alice Shea Creeks is coarse and nuggetty; most of the grains are larger than wheat kernels. The gold from lease Nos. 345 and 402 is similar. It occurs in rounded or flattened grains and nuggets whose surfaces may be smooth or irregularly pitted and rounded. The surface is dull and almost uniformly orange-yellow in colour, but beneath the oxidized surface coating, the gold is bright and yellow. Most of the large nuggets have quartz still adhering to them. Of the largest nuggets recovered from Wheaton Creek one, found above the falls on lease No. 302, weighed 2 ounces 2 dwt., and another found on lease No. 345 weighed just about 2 ounces. The average fineness of almost 700 ounces of gold from lease No. 345 is 831 parts of gold, 121 parts of silver. The simi-

larity of the gold from lease No. 402 to that from lease No. 345 is shown by the former's fineness of 827 parts of gold and 123 parts of silver. Amongst some of the gold recovered from the Peacock lease was one nugget about the size of a small bean. The nugget is about half gold by volume and the gold surrounds and includes some soft, light greyish-green material which on microscopic examination is found largely to be altered pyroxene and a very small amount of serpentine. One other small nugget was partly gold and partly an incrustation of copper carbonate. Unfortunately most of the gold, other than the large nuggets, lacks quartz or other rock that might give some indication of its original source.

Most of the gold so far recovered from Alice Shea Creek has been from lease No. 355. That practically all of it is exceedingly coarse may be attributed to the steepness of the creek grade which allowed most of the fine gold to move downstream to a flatter grade. The largest nugget, found in 1937, weighed 52 ounces 15 dwt.; numerous others weighing up to 16 ounces have been found. On the average, the gold is much coarser than that on either lease No. 345 or No. 402.

Some of the gold, particularly that recovered from slate bed-rock, has a surface coating of brown iron oxide. Apart from this superficial coating, the colour of the gold differs in various nuggets. Moreover, different types of gold are suggested by the range in fineness of some of V. Shea's gold shipments. The fineness of which ranges from 775 parts of gold and 205 parts of silver, to 798 parts of gold and 180 parts of silver. At least three different types of gold have been recognized, all of which are sufficiently well defined to be readily identified. One has a brass yellow colour, a small nugget of which had a fineness of 819 parts of gold. A second, light orange-yellow in colour, is crystalline in some nuggets and in others has a peculiar web-like or graphic surface pattern. Some of these gold nuggets have quartz in them and their fineness is 773 parts of gold. A third type is light yellow or almost lemon-yellow in colour. Some of these nuggets are finely crystalline, rough and hackly with quartz still adhering to them. Others, that are slightly worn have a distinctive surface pattern that has resulted from the flattening of the original crystal outlines. The fineness of a small nugget of this last type, is 716 parts of gold.

Amongst the gold recovered by V. Shea during the summer of 1939 was an elongated heart-shaped nugget about 2 inches long. It was estimated to contain less than a fifth gold by volume. The nugget was white, stained slightly brown with

iron oxide and composed of orthoclase and albite but no quartz. The gold occurred as wires and thin leaves encircling and cutting the grains of feldspar. Other nuggets largely gold have feldspar attached to them. The fineness of this gold is 741. The feldspar is moderately coarsely crystalline and no quartz was seen in any of the nuggets examined.

One fact is, that not only does the gold from Alice Shea Creek look different from that from leases Nos. 345 and 402 on Wheaton Creek but a real difference between them is shown by their fineness.

The black sand concentrate recovered from the sluice-boxes consists of magnetite, small grains of a natural nickel-iron alloy (awaruite), pyrite, hematite, chromite, as well as native copper nuggets several inches across. No platinum is reported and none was observed in the heavy concentrate.

The awaruite grains from the placer concentrates are as much as 3 millimeters long. Under the microscope most of them are rounded and worn, but some show crystal faces. The mineral is malleable, sectile, and magnetic. The grains have a light bronze colour but the mineral on a cut or polished surface is grey. The colour of awaruite will serve to distinguish it from platinum, some of which may be magnetic. A sample of awaruite picked from a magnetic concentrate made from the black sand assayed: Nickel 72 per cent., iron 23 per cent., cobalt 4 per cent. and copper 1.1 per cent. A similar alloy has been recovered from auriferous gravel on the Fraser River 2 miles from Lillooet, B. C., Bridge River, B. C., Hoole Canyon on the Pelly River, Y. T., Awarua Bay, New Zealand, and Josephine County, Oregon.

Several samples of serpentine, taken from the belt outcropping along Wheaton Creek, were crushed and panned. The black sand concentrate from them contains magnetite, pyrite, pyrrhotite, chromite, and grains of awaruite. This mineral was also recognized in microscopic examinations of polished surfaces of serpentine. It is evident, therefore, that the awaruite occurs in the serpentine and that the awaruite in the gravel has been concentrated by the erosion of serpentine.

Gold value of gravel. There is little precise information regarding the gold value of the gravel. V. Shea, however, reports that on lease No. 355 he recovers about three-quarters of an ounce of gold per lineal foot of creek-bed. On lease No. 345 on Wheaton Creek the values are higher. During the autumn of 1938 it is reported that about $12,000.00 in gold was recovered from a small patch of shallow gravel

(see Fig. 4). The recovery was roughly a dollar per square foot of ground worked. In 1939, three test-shafts were sunk in the valley-bottom to the south of the ground worked in 1938. The recovered gold from one shaft, about 5 feet square, gave a value of almost 3 dollars a square foot on bed-rock. In the drag-line excavation made during the summer of 1939, the value of recovered gold per square foot on bed-rock was even higher. Complete information is not available. On lease No. 402 immediately down-stream from lease No. 345 the gold values are considerably less than those on the Peacock lease. In certain sections worked in the bottom of the creek, the recovered gold was equivalent to a value of about 50 cents per square foot of bed-rock cleaned. The fact that this value is considerably lower than those on the Peacock lease needs some explanation. It evidently must be related in some way to the origin and deposition of the gold.

Origin of the Placer-Gold. The primary sources of the placer-gold are in the rocks that outcrop in the drainage area of Wheaton Creek. Because of the coarseness of the placer-gold on Wheaton and Alice Shea Creeks it is believed that the gold on each is close to its source. Moreover, the difference between the gold on Wheaton Creek and that on Alice Shea Creek indicates a distinctly different source for each. The variety of gold on Alice Shea Creek alone suggests different sources for each type and that it all did not come from the same vein. There is little support for the belief that gold found on Wheaton Creek migrated down-stream from a source on Alice Shea Creek.

Slate and serpentine are the two rocks that outcrop most extensively. There are innumerable quartz veins and stringers in the slate. All the samples taken of quartz veins assayed nil and no gold-bearing quartz veins have been reported from the area. Despite this, and in view of the fact that the large gold nuggets contain quartz, it is believed that much of the placer-gold has come from quartz veins in slate or other sedimentary rocks. Although the sedimentary rocks now outcrop in two main belts and in numerous small areas in the serpentine, it should be recognized that formerly, before Wheaton Creek cut to its present level, slate and other sedimentary rocks outcropped over the entire area.

No quartz veins were seen in serpentine nor was there any evidence of sulphide mineralization. In fact, some quartz veins in diorite, traced to a contact with serpentine end abruptly at the contact. Consequently, the numerous quartz veins in the slate belts lend strength to the belief that some were auriferous even though none are known to carry gold. On

the other hand, one small nugget, from the Peacock lease, composed of gold, pyroxene and a small amount of serpentine suggests that it might have come from gold mineralization in serpentine; therefore the possibility of finding a gold-bearing lode in serpentine must not be ignored completely.

Several gold nuggets containing feldspar but no quartz were recovered from Alice Shea Creek. The feldspar is moderately coarsely crystalline. The only rock of similar composition is an aplite dyke in slate near the head of Wheaton Creek. Neither pegmatite dykes nor feldspatic quartz veins were seen anywhere, but it is strongly suggested that one, mineralized with gold, was the source of some of the placer-gold on Alice Shea Creek. The white feldspar showing good cleavage might be a valuable marker for a dyke or vein that supplied some of the placer-gold.

The outcrops of auriferous lodes were weathered and eroded during the Tertiary. The gangue of any auriferous veins was broken down and the host-rock disintegrated. After a considerable time hillside eluvial placers might be expected to form near the outcrops of any gold-bearing deposits. With downhill soil-creep and surface rainwash, gold and other resistant minerals would migrate downhill and be further concentrated in placers in the creek-bottom. It is believed that most of the placer-gold was released and formed gold-bearing stream-placers prior to the Pleistocene because the amount of post-glacial bed-rock erosion is so slight that little or no gold would have since been set free. The absence of hillside eluvial placers at present is explained by the heavy run-off that no doubt preceded the glacial epoch and the destructive erosion by glacial ice.

Alice Shea Creek flows only 10 to 15 feet below the bottom of the late Tertiary creek. Gold was concentrated in the gravel, and on bed-rock in the bottom of the Tertiary creek. Although at present, bed-rock on the valley-sides is overlain by glacial boulder-clay, the Pleistocene ice erosion apparently was not sufficiently great to disperse all the gold. The absence of a cirque at the head of the creek probably accounts for the lack of erosion. In post-glacial time Alice Shea Creek cut below the Tertiary valley-bottom and reconcentrated any gold that was in the boulder-clay or that lay on, or in the bed-rock. Consequently the gold concentration is on bed-rock or in the shallow post-glacial gravel of the present creek.

The rejuvenation of Wheaton Creek and its incision towards the close of the Tertiary resulted in the concentration

of the placer-gold and in its redeposition at progressively lower elevations as the creek deepened its channel. Rock benches might be left by any swinging of the creek from side to side and placer-gold might be deposited on them. The rock bench to the east of Barrington's camp and 25 to 30 feet above it may be one of these. The early glaciation apparently did not disperse its gold.

On the Peacock lease a bed-rock channel, separate from the late Tertiary one, was cut during the interglacial stage (see Fig. 5). In it, gold is on top of flat-lying, thinly-bedded clay in the bottom of the channel. The gold is believed to be reconcentrated from a higher, Tertiary gold concentration left on the rock bench lying to the east. An unsorted clayey gravel was deposited above the clay prior to the readvance of the ice. Although gold is disseminated through the gravel, most of it is close to the clay at the bottom. Because there was little or no stream sorting, the gold is not in a well-defined pay-streak, its only confining limits being the sides of the channel. A further irregularity may have been introduced by the erratic distribution of earlier gold accumulations left more or less untouched by the early ice advance. The gold being mined in the channel on the Peacock lease was deposited in the interglacial stage and is a reconcentration of pre-glacial gold accumulations. The last ice advance was again not sufficiently erosive in the bottom of the valley to disperse the interglacial gold concentrations.

Wheaton Creek re-occupied its valley after the disappearance of the ice and re-excavated its channel almost down to the late Tertiary and interglacial levels. In so doing, it cut a post-glacial canyon on the upper part of the Elvira lease (No. 402) and concentrated, on bed-rock, gold that formerly had been in any glacial debris and in the bottom of the deepest of the late Tertiary channels. Gold on lease No. 302 was reconcentrated by the present creek and rests on bed-rock below creek-level.

On the Peacock lease, post-glacial down-cutting of the creek reconcentrated, in surface gravel the gold dispersed through glacial debris and gold that may have been left on or along the edge of the rock bench to the east of Barrington's camp.

Two factors may account for the gold values on lease No. 402 being much lower than those on the Peacock lease. First, the auriferous interglacial channel mined on the Peacock lease is believed to exist as a buried channel lying to

the west of the canyon of Wheaton Creek on lease No. 402. This buried channel is believed to diverge from Wheaton Creek beneath the tractor-road by the head of the rock-canyon at the north end of the Peacock lease. Secondly, the slate-serpentine contact cuts across Wheaton Creek on the Peacock lease. The placer on the Peacock lease may be closer to the source and consequently be richer than placer-deposits farther down-stream. The gold on the two leases is similar and evidently comes from the same source. The placer-gold north of the Peacock lease may have migrated down-stream and if so might indicate to what extent coarse gold will travel even down a low grade.

A consideration of the hypotheses advanced to explain the physiographic history and the origin and deposition of the placer-gold leads to the following conclusions.

1. The gold, on Alice Shea Creek and on the leases at the lower end of Wheaton Creek, is believed to have come from different sources. The gold on lower Wheaton Creek did not travel down-stream from a source on Alice Shea Creek. Most of the gold is believed to have come from quartz veins in the slate though some may be from lodes in serpentine or from an auriferous pegmatite or feldspathic quartz vein. Although no auriferous gravel has yet been found on the leases between No. 345 and the mouth of Alice Shea Creek, there is no assurance that none is there. However, there is no doubt that any gold found will be on or close to bed-rock beneath the present creek. The valley is so confined that the chance of there being a separate auriferous channel is extremely unlikely.

2. A channel of interglacial age is being mined beneath creek-level on the Peacock lease. The northward extension of the channel is believed to lie buried to the west of the canyon of Wheaton Creek on leases No. 402 and 302. The extension of the channel diverges from Wheaton Creek beneath the tractor-road at the north end of the Peacock lease. There is no assurance that the northward extension is auriferous even though the channel is gold-bearing on the Peacock lease. Furthermore, its presence is not necessarily expressed by a surface depression though indirectly it might be indicated by an alignment of kettle-holes.

3. A buried late Tertiary channel lies to the east of Wheaton Creek and extends from a point east of Wheaton's camp southward to a point 1,200 feet south of Barrington's camp. At its northern end the channel is a dry gulley and to the south it is completely filled with glacial debris. Its whole length might be auriferous in view of the fact that the north-

ern end is gold-bearing.

4. The absence of fine gold on Alice Shea Creek may be a direct result of the steep creek grade. The surge of spring freshets and the breaking loose of ice-dammed water over shallow auriferous gravel on a steep grade would probably move most of the fine gold down-stream. Alice Shea Creek joins a fairly flat stretch of Wheaton Creek. If any fine gold migrated down Alice Shea Creek it might be expected to stop on the flat Wheaton Creek grade. Any gold would probably be concentrated on bed-rock beneath creek-level.

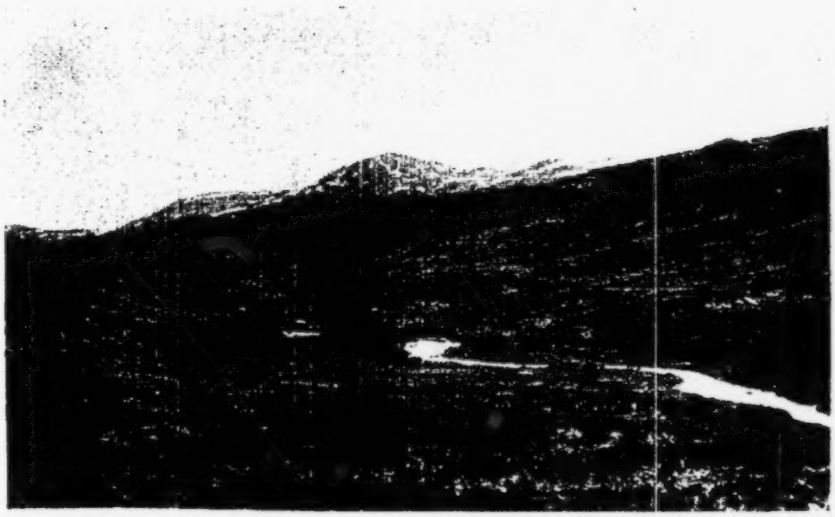
5. Alice Shea Creek, in its lower stretch below the canyon, makes a wide sweep to the south (see Fig. 1) before joining Wheaton. A drift ridge below the canyon entrance and at the start of the sweep suggests that the pre-glacial channel does not coincide with the present lower course of the creek. There is a depression immediately east of a serpentine ridge east of the No. 2 post of lease No. 360. The buried channel of lower Alice Shea Creek may run between the foot of the canyon and the point just mentioned. Any gold in the channel would probably be on bed-rock.

6. Placer-gold deposits in the lower stretch of Wheaton Creek were partly protected from ice erosion because of their position near the bottom of a canyon incised in a wide valley. Canyon incision in late Tertiary and interglacial time did not progress far south of the mouth of Alice Shea Creek. Consequently, any concentrations of placer-gold in Wheaton Creek valley south of the mouth of Alice Shea Creek were probably dispersed during the Pleistocene.

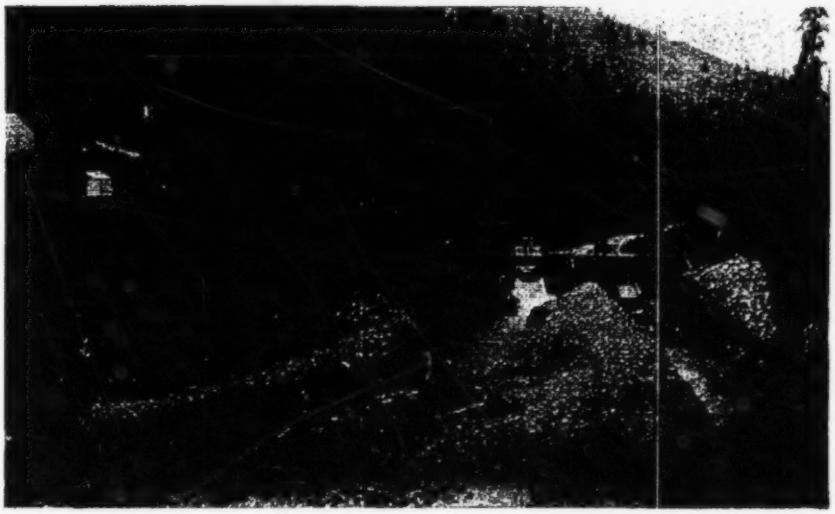
Methods of Working. Conditions on Wheaton Creek are not suitable for hydraulicking the auriferous gravel. The lack of sluice-box grade and dump space combined with large boulders and only moderate water-supply (about 30 second-feet) make the method impracticable.

In the section of Wheaton Creek north of the Peacock lease the creek-grade is sufficiently steep and the gravel overlying bed-rock sufficiently shallow so that by ground-sluicing or booming it is possible to uncover and clean bed-rock. Ground-sluicing has been attempted without satisfactory results, on the flatter section of the creek south of lease No. 402 but the creek is too flat (roughly 2 to 2 1/2 per cent.) and the gravel too deep for bed-rock in the bottom of the creek to be reached by this method.

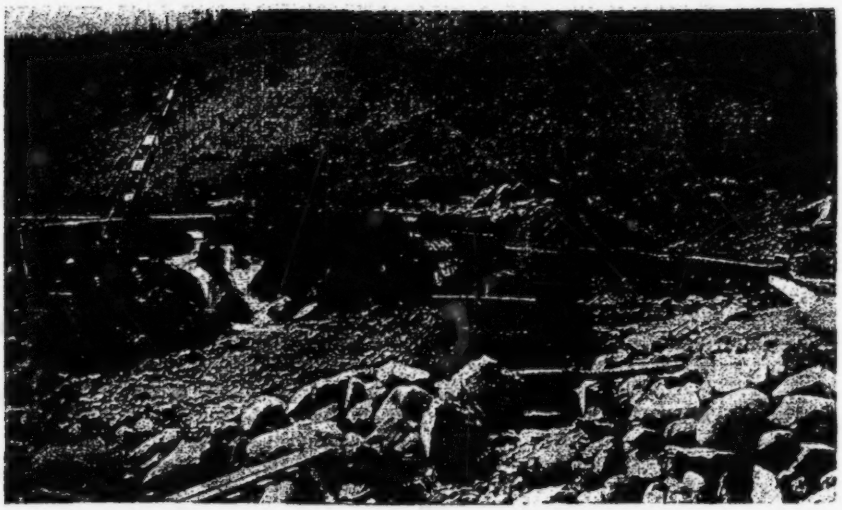
The value of the auriferous gravel is sufficiently high



Looking southward along the wide, open valley towards the head of Wheaton Creek.



Booming-dam and ground-sluice cuts on the Roosevelt lease. Prospect-shaft between cuts in the middle foreground.



Drag-line shovel, movable sluice-box, and bulldozer stacking tailings at Boulder Creek Mines operation on the Peacock lease.

Sluice-boxes set up on the Nugget lease on Alice Shea Creek. Boulders are piled on the side and bed-rock cleaned by hand.

on the Peacock lease to support a more expensive method of working. The excavating is done by a 7/8-yard drag-line shovel. The gravel is dumped into the hopper of a moveable sluice-box built on skids. Any tailings that accumulate at the end of the sluice-box are stacked by a bull-dozer. In order to work in a dry pit below creek-level it was necessary to build an enclosed box-drain southward from the north end of the Peacock lease. The excavation is made by the drag-line, and the cribbed-drain is built on the bedded clay and lagged on top. The excavation at the down-stream end of the sluice-box then fills with the tailings from the sluice which rests on top of the box-drain. When the shovel has completed digging a pit and the bed-rock has been cleaned, the drain is built ahead, lagged over, and the sluice-box skidded forward on top of it. It is possible, by diverting the creek around the excavation, to work 20 to 25 feet below creek-level in a comparatively dry pit. Large boulders in the gravel impede digging operations and increase costs by the time lost and the expense of blasting them. Provided drainage can be maintained, and provided the depth of gravel does not become too great, nor the gold content of the gravel too low, this method of operation is suitable for working Wheaton Creek.

Alice Shea Creek flows over only a few feet of gravel on a steep grade. Any large boulders are dragged to the sides by a 5-ton winch operated by a small gasoline engine. The creek during most of the summer is small enough to be carried in a 12-inch sluice-box. Consequently, a small sod dam is built, the creek diverted through the string of sluice-boxes and the gravel shovelled from bed-rock by hand. Bed-rock is carefully cleaned to avoid missing any coarse gold that may be lodged in the cracks.

PROSPECTING POSSIBILITIES

Hitherto lode prospecting in Wheaton (Boulder) Creek area has not resulted in the discovery of any auriferous veins even though the coarseness of the placer-gold suggests that it is close to its source. The presumably separate sources for the gold on Wheaton and Alice Shea Creeks should materially reduce the area worth prospecting. The evidence suggests that much of the gold came from auriferous quartz veins in the slate and sedimentary rocks but search for mineralized zones or veins in serpentine should not be completely overlooked.

The gold on Alice Shea Creek is exceedingly coarse and extends to the head of the creek. It is evidently close to its source, presumably veins in slate. On Alice Shea Creek, however, some of the gold at least, appears to have come from

an auriferous pegmatite or feldspathic quartz vein, the rest appears to have come from quartz veins. Although Alice Shea Creek is not rich in comparison with other placer creeks, the search for the source of its gold is worthwhile. Furthermore, the small drainage area of the creek should confine prospecting to a comparatively small tract. The main difficulty is that the valley-sides are largely covered with drift and bed-rock outcrops in few places other than in the creek-bottom and on the ridge-tops. The drift is glacial boulder-clay so that panning to recover any gold colours probably would not reveal the presence of an underlying auriferous vein.

On Wheaton and Alice Shea Creeks most of the ground that offers any possibility for the occurrence of placer-gold has been staked. The chance of finding gold on Wheaton Creek south of the present limit of leases is not as good as it is in the canyon-section to the north. Nevertheless, bed-rock testing to the south should not be overlooked. The leases already staked merit further placer prospecting. There is insufficient evidence to permit definite conclusions to be made, consequently further prospecting in selected places would do much towards giving a definite answer to the following questions.

1. Is there gold on bed-rock below Wheaton Creek on the leases between the Peacock lease and the mouth of Alice Shea Creek?

2. Does an interglacial channel extend northward from the Peacock lease and lie to the west of the canyon on lease No. 402? If it does, is it auriferous?

3. Is there a concentration of gold on bed-rock beneath the bedded clay in the bottom of the interglacial channel on the Peacock lease?

4. Is there a buried, auriferous, Tertiary channel that extends southward from a point opposite Wheaton's camp and lies on the east side of Wheaton Creek?

5. Has fine gold migrated down Alice Shea Creek and is there a concentration of it on bed-rock below creek-level at the mouth of Alice Shea Creek?

6. Is there any pay-gravel on the rock benches that flank Wheaton Creek north of the mouth of Alice Shea Creek?

7. Is there a buried channel of Alice Shea Creek lying between the lower end of the canyon on Alice Shea Creek and a point about 300 feet east of the No. 2 post of lease No. 360? If so, is there a concentration of gold on bed-rock in it?

The physiographic history of Wheaton Creek was developed in detail not only to explain the origin and occurrence of placer-gold on Wheaton but in the hope that the outline might be found useful in directing placer-prospecting on other creeks. Although no other creeks were visited, it is suggested that the physiographic history of Wheaton Creek is similar to others, as many tributaries enter the Turnagain valley over falls.

Several factors govern the occurrence of placer-gold on Wheaton Creek. First, there must have been auriferous veins in the drainage area of the creek. Secondly, all the early placer concentrations were not dispersed during the Pleistocene. That the gold is found in a canyon below the Tertiary valley-bottom largely explains why the placer was protected from ice erosion. Though Wheaton Creek is roughly parallel to the general movement of glacial ice, the absence of cirques and of ice gathering grounds partly accounts for the small amount of ice erosion.

A source of gold should always be considered before prospecting the country for other placer creeks. The chances are slight of finding placer-gold on creeks whose drainage areas are completely underlain by granitic rocks. Whereas if many veins are known to outcrop in the drainage area and particularly if any are known to be auriferous the chance of finding placer is much greater. The drainage areas of many known placer creeks are underlain by slate carrying quartz veins.

No creeks in northern British Columbia are entirely unglaciated, but search should be made for valleys where ice erosion has not been excessive. Such valleys may run generally eastward or westward, transverse to the general direction of ice movement, or may be ones with no cirques or high ice gathering ground at their heads. Those valleys may still retain their V-shaped profile rather than the trough-like form of glaciated valleys.

On any particular creek, the initial prospecting of all gravel exposures should be followed by an attempt to reach bed-rock particularly if there is a place comparable to the canyon-section of Wheaton Creek.

DESCRIPTION OF LEASES

On Wheaton (Boulder) Creek.

Johnson, Ryan and Elvira Leases. J. Wheaton of Telegraph Creek, B. C., owns the Johnson (No. 301), Ryan (No. 302)

and Elvira (No. 402) leases. The Johnson and Ryan were the first leases staked on Wheaton Creek. Later, Wheaton staked the ground now known as the Elvira lease. These three cover the lower canyon-section of the creek where the shallow depth of bed-rock gravel and 4.9 per cent. creek-grade allow the gravel to be easily worked by ground-sluicing or booming.

The first gold recovered from Wheaton Creek was mined by Carl Johnson just above the falls on lease No. 302. Wheaton, after he had bought the Johnson and Ryan leases, started work in the same place. He built a booming-dam about 500 feet south of the falls and cleaned a strip of bed-rock in the bottom of, and below the level of the creek. Later he built a two-gate booming-dam about 1,200 feet down-stream from the final post of the Elvira lease. In the summer of 1939 he was working a strip of creek-bottom which extends for about 550 feet down-stream from the dam. The creek-bottom between the confining canyon walls reaches a width of about 75 feet. Bed-rock below creek-level is covered with 8 feet of cleanly-washed gravel. Most of the gold lies on bed-rock, but some may be scattered through the overlying gravel. Apparently the gold was deposited during post-glacial creek cutting.

During the late summer of 1939 three men, under a lay-agreement with J. Wheaton, worked a short stretch of creek-bottom about 200 feet south of the old dam on lease No. 302. Two other men were working on the east side of Wheaton Creek opposite Wheaton's camp. They started an open-cut at the north end of a buried channel at the point where it joins the canyon of the creek. Gold was recovered in paying quantities from the surface gravel in the floor of the filled channel. Bed-rock had not been reached in the open-cut which was being advanced southward.

Peacock, Amanda and Philippon Leases. Boulder Creek Mines Ltd., a private company, with offices at 1010 Hall Building, Vancouver, was incorporated in December 1938. The Peacock (No. 345), Amanda (No. 346) and Philippon (No. 361) leases were optioned in the autumn of 1938 by S. C. Barrington on behalf of the company which was formed later. A camp was established on the Peacock lease in the spring of 1939. S. C. Barrington was at the camp on Wheaton Creek and J. Walsh was superintendent in charge of operations.

The first work done by P. Peacock on lease No. 345 was to build a booming-dam across Wheaton Creek about 1,200 feet south from the present Barrington camp (see Fig. 4). The creek-grade is low and the depth to bed-rock so great that the attempt to reach bed-rock by ground-sluicing was abandoned.

Later he built another dam across the creek about 200 feet south of the Barrington camp (see Fig. 4). During the seasons of 1936, 1937, and 1938 Peacock, ground-sluiced a cut below creek-level and recovered coarse gold on top of bedded clay and in clayey gravel in an interglacial channel. Except at the east side of the booming-dam, no bed-rock was exposed. In the autumn of 1938 some of his men, who were "sniping" along the bench beside the creek, discovered exceedingly rich gold-bearing gravel. Within six weeks gold valued at about $12,000.00 was recovered from a small area beside the creek at the south end of the gravel bench on which Barrington's camp is built.

Operations by Boulder Creek Mines Ltd., began in 1939. The gravel being worked lies on bedded clay 15 to 20 feet below creek-level. Work was started by the company at the lower end of the Peacock lease by excavating for a box-drain. The drain is carried up-stream on top of the bedded clay and is advanced as the digging proceeds. In the early part of the 1939 season, the shovel was digging in worked-out ground, but by July the excavation had advanced into virgin gravel about 500 feet from the north end of the lease. A 7/8-yard drag-line-shovel equipped with a 47-foot boom, and caterpillar tracks, is used for digging. Wheaton Creek is diverted around the excavation through a ditch. The shovel stands on top of the gravel and digs a pit below creek-level. Gravel from the pit is cast into the hopper of a moveable sluice-box which stands on top of the box-drain. All the gravel is washed in the sluice-box, the gold is caught by riffles and the tailings accumulated at the lower end of the sluice. The tailings are stacked by a bull-dozer if they block the end of the sluice before it is necessary to move the set-up. When the pit is dug to the limit of the drag-line boom radius, the box-drain is built ahead, lagged on top and sides, the sluice-box skidded forward on top of it, and digging begins again. Care is necessary to keep the level of the drain low enough to maintain drainage at all times. In the summer of 1939 the intervals between moves ranged from 7 to 10 days. All large boulders encountered are blasted to a size that can be handled by the shovel and are then stacked in piles on each side of the pit.

At present there is little indication of a pay-streak on the bedded clay. The channel, however, is narrow and is confined by sloping bed-rock on each side. Gold was recovered from the east side on a slope rising from the bottom of the channel. It is believed that the gold came from a reconcentration of gold that formerly lay on the bed-rock bench lying to the east of Barrington's camp. Consequently an ill-defined

pay-streak may follow the eastern rather than the western side of the interglacial channel. Three 4- to 6-foot prospect-shafts were sunk in the creek-bottom south of the drag-line workings. Bed-rock was not reached but a concentration of gold in one was found on clayey gravel at a depth of about five feet. Although sufficient prospecting has not been done, the gold in the prospect pit further suggests that a pay-streak may extend along the eastern side of the channel. A buried channel which may lie farther to the east of the creek offers further prospecting possibilities.

The Amanda and Philippon leases are separated from the Peacock lease by two creek leases, the Roosevelt (No. 336) owned by F. Bobner and the Alice (No. 332) owned by Mrs. Alice Shea. Several years ago a booming-dam was built across Wheaton Creek about 100 feet north of the No. 2 post of the Amanda lease, and an unsuccessful attempt was made to reach bed-rock beneath the creek. Some prospecting has been done on the Philippon lease, but no pay-gravel has yet been found either on it or on the Amanda lease. Bed-rock beneath the creek has not been tested.

Roosevelt Lease. The Roosevelt lease (No. 336) which lies immediately up-stream from the Peacock lease (see Fig. 1) is owned by F. Bobner of Juneau, Alaska. Bobner prospected the benches on each side of the creek without success. In 1938 he built a booming-dam across Wheaton Creek about 500 feet south of the No. 1 post of the Roosevelt lease. He was, however, unable to reach bed-rock beneath the creek and recovered only a few pieces of coarse gold on sloping bed-rock on the side of the ground-sluice cut. In the summer of 1939, he and his partner sank a shaft to a depth of 26 feet in gravel in the creek-bottom, but were forced to abandon the shaft before reaching bed-rock. The gravel contains black sand and only a few small gold colours. They were unable to test bed-rock below the creek.

Alice Lease. The Alice lease owned by Mrs. Alice Shea lies between the Roosevelt and the Amanda leases. The ground was staked and prospected by the Sheas before they found gold on Alice Shea Creek. They built a booming-dam 600 feet south of the No. 1 post of the Alice lease but were unable to reach bed-rock in their ground-sluice cut. They did, however, recover a very small amount of coarse gold on sloping bed-rock exposed along the side of the cut.

Caribou Lease. The Caribou lease (No. 360), which adjoins the Philippon lease on the south, is owned by S. F. Faherty. In 1938 a shaft was sunk on the west side of Wheaton

Creek about 70 feet south of the No. 1 post of the Caribou lease, and was abandoned at a depth of 12 feet. A drill-hole was put down 19 feet below the bottom of the shaft and it is reported, that no bed-rock was reached even at a depth of 31 feet below the creek. A second shaft, sunk beside the creek at a point about 650 feet north of the No. 2 post of the Caribou lease, was also abandoned at a depth of 14 feet in clayey gravel.

A third attempt to reach bed-rock beneath the creek was made by using an ingeniously-built, home-made drag-line shovel. A cut was started about 250 feet north of the No. 2 post of the Caribou lease but was abandoned when it had reached a depth of 18 feet.

Peanut Fraction, Bonanza and Beverly Leases. The Peanut Fraction (No. 370) and Bonanza (No. 409) leases are owned by E. J. Brown, and the Beverly (No. 410) by D. A. McPhee. The leases lie along Wheaton Creek up-stream from the mouth of Alice Shea Creek. A little prospecting has been done on them, but, as yet, no pay-gravel has been found.

ON ALICE SHEA CREEK

Sluice Box, Rainbow, Nugget and Sunset Leases. There are four creek leases staked along Alice Shea Creek, up-stream from its mouth. The Sluice Box lease (No. 353) is owned by J. J. Shea, the Rainbow (No. 354) and Nugget (No. 355) by V. Shea, and the Sunset (No. 356) by J. G. Hope. It is understood that V. Shea has an interest in the Sunset lease.

All four leases have been partly prospected and gold found on them. During 1939, V. Shea was working on the creek about 700 feet down-stream from the No. 2 post of the Nugget lease, close to the point where the 52 ounce 15 dwt. gold nugget was found in 1937. Most of the gold on Alice Shea Creek is coarse, and in 1939 Shea recovered nuggets ranging in weight from 1 to 16 ounces.

The gold is on bed-rock across a width of about 50 feet and beneath 1 to 3 feet of gravel. It is apparently a post-glacial concentration of gold from bed-rock or boulder-clay, which form benches along the sides of the creek.

Before a stretch of creek is worked, all large boulders are pulled to one side by a 5-ton winch driven by a small gasoline engine. The creek-grade is steep and the shallow gravel is shovelled by hand into a string of 12-inch sluice-boxes. During most of the year the creek is small enough to

be entirely carried through the sluice-boxes, only in high water in the spring is it necessary to divert part of it. After the gravel is shovelled clear, bed-rock is carefully cleaned by hand so as to recover any gold that may be lodged in cracks.

Note. For those who specially request it, prints of Fig. 1 on a scale of 400 feet to 1 inch may be obtained for $1.50 each.